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Getting There from Here
Remembering the Future of Digital Humanities

Roberto Busa Award lecture 2013[1]

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Prologue

The text which follows was written as a lecture for a specific audience on a unique occasion, in a social setting that is now irretrievably gone. This setting allowed freedoms that are apt to seem out of place in the present context. But I exercised them for a reason which survives: in the spirit of Bruno Latour's advice in 'The Politics of Explanation', to foreground the struggle of making an argument rather than to give an impression of having captured some truth or other (1988: 162–3). On behalf of digital humanities I wanted to foreground the poverty of language (some would say of theory, others of criticism) that for most if not all of its history has made this struggle so difficult. As Clifford Geertz said on behalf of anthropology, 'We are reduced to insinuating theories because we lack the power to state them' (1973: 24). Whether my suggestion of a language gains purchase among those for whom the lecture was written remains to be seen. I do not insist on it as the sole possibility or even the best. But I do insist that this poverty of language should rank first among items on the agenda to be addressed and that its solution is to be found by putting the field into its historical context.

Retrospective introduction

I am greatly honoured by the Busa Award, especially because it is given by the community of people among whom a quarter-century ago I found the intellectual home where I have thrived and prospered. I've thought long and hard about what to say: whether to present new results or to make something of how I got here from there. I've decided to do both: new results because I suffer from intellectual claustrophobia and want reactions to the cure I'm taking; retrospection because this occasion demands that a 'life of learning' be told as a meaningful story.[2]

Retrospection first. I cannot describe anything remotely like a career path because there was none. My trackless wanderings were affected by far too many accidents, though (I like to think) steadily driven by hunger for learning. Let me just say that I came to the PhD in Milton studies in 1976 with training in physics, English,

German and Latin literature and mathematics, and years spent as a programmer in Fortran and assembly language on some big machines. Eight years of obsessive devotion to John Milton's biblical and classical sources earned me the degree in 1984. The plan was to become a professor of English, but that didn't happen, despite powerful help. I spent a dozen years in academic limbo. While there I reverted to computing, moved into humanities computing (as we called it then),[3] learned a lot about other people's research and fell into a prolonged study of Ovid's *Metamorphoses*, by which I had become captivated. Its structure fascinated me. How, I wondered, did the poem manage so successfully to tease us with promise of structure yet always elude our grasp? Like Father Busa before me I turned to computing for help, on a smaller scale but for the same reasons.

Markup seemed the obvious way to go. SGML was the standard, TEI as yet unborn. I created my own scheme, rejecting SGML to make sure that my thinking would be as free from pre-existing theoretical commitments as possible.[4] I targeted names, which I reasoned were literary enough to tell me about structure, verbal enough to handle with a machine. Names quickly became all devices of language indicating persons. About 60,000 tags resulted, that is, an average of five per line of poetry. I worked on it both alone and with research assistants,[5] in Toronto and then in London after moving there in 1996, finally abandoning it when at last I realized that markup was radically wrong for the job, indeed that no conceivable technology would prove remotely adequate. But no matter: those years of work had already led me to the vein of gold I have been following ever since: an idea of what happens when Mr Turing's implemented idea of mathematical rigour meets the fluid, metamorphic genius of poetry.

Back up some years. In April 1987 at the International Conference for Computers and the Humanities in Columbia, South Carolina, I met Michael Sperberg-McQueen, whose eloquent rhetoric stirred up the righteous discontent of colleagues who like me were languishing on the academic periphery. *Humanist* was the result.[6] I threw myself into it, never for a moment thinking it would pay off. How wrong I was! Nearly a decade later, in 1996, Harold Short, whom I met in Toronto because of *Humanist*, changed everything by seeing to it that I was propelled quite unexpectedly across the pond into my first academic appointment, which I still hold. *Humanist* continues to be my primary academic forum.

I take the moral of this story from the great twelfth-century Jewish philosopher Moshe ben Maimon's *Commentary on the Mishnah*:

> כל שאתם עושים לא תעשו אלא מאהבה
>
> whatever you do, do it only out of love.[7]

And from the physician Thomas Fuller's *Gnomologia* (1732), I draw these helpful proverbs to hammer it home:

> He that hath Love in his Breast, hath Spurs at his Heels (2160);
> Love will creep, where it cannot go (3301);

> Love lives more in Cottages than Courts (3290); and finally,
> The Soul is not where it lives, but where it loves (4761).

To put the matter more personally and viscerally, I didn't walk a career path but followed the smell of food on the wind. And here I am, to say thank you all for the friendship, inspiration, sustenance, audience and now this, in the name of the great Jesuit scholar, Roberto Busa. *Mille grazie*!

But I do wonder, why me? I am a quite old-fashioned scholar, who works by himself, shuns collaborative teams and the grants that fuel them, who has written no code for decades, knows not TEI and teaches solely face to face. For many years I have insisted, contrary to Ronald Reagan when he worked as promo-man for General Electric (Reagan 1961), that failure is our most important product, partly for the shock value, as antidote to the hype of pervasive techno-triumphalism, but also to stress that computing is an ongoing, never-ending *experimental* process.[8] I've argued that the main thing is to fail so well that all you can see is Jerome McGann's 'hem of a quantum garment' (2004, 201)—a phrase he used, you may recall, to describe the intractable non-residual leftovers markup cannot capture, hence its potential for illumination.

My struggle with the *Metamorphoses* laid groundwork for my book *Humanities Computing* (2014/2005). Twenty years earlier Brian Cantwell Smith had observed that computers can only approximate reality according to a necessarily simplified, hence incorrect model of it (Smith 1985). So I could see that in principle my attempts to pin Ovid down were bound to fail. But by the time I came to think about Ovid two things had happened: progress had liberated digital computing from its confinement to mainframes, giving me a little machine of my own to play with; and I had met the great Australian ethnohistorian Greg Dening, who introduced me to the present participle (Dening 2002, 1993). So I could see that Brian had fastened on the wrong part of speech: *modelling,* not *model,* had to be the central idea. In other words I rediscovered the essential truth of the hackers' 'Hands-on Imperative' against the industrializing effects of batch-mode computing (Levy 2010/1984, 28). And so the book. But then, as always, intellectual claustrophobia took hold. By demonstrating the conceptual inadequacy of our tools, modelling the *Metamorphoses* had left me nowhere to go. And modelling itself was at once too pat an answer and unable to do more than work through consequences of interpretation that had already happened—elsewhere by other means.

Coming to the end of my own road alerted me to the others whose fate I shared, and so to wonder if I might figure a way out by finding out what it had been like for them. Hence my turn to history.

A history of the present from an emotional past

What I found, and what I think it amounts to, forms the remainder of this lecture. But I am going to tell you a particular *kind* of story, which I learned about from Ian

Hacking (to whom I owe so much), who learned about it from Michel Foucault: a 'history of the present', Foucault called it, because it sets out to 'recognize and distinguish historical objects in order to illumine our own predicaments'.[9] Writing in 1940 with the Gestapo at his heels, Walter Benjamin put the case more starkly, just as we need it to be:

> To articulate the past historically does not mean to recognize it 'the way it really was' (Ranke). It means to seize hold of a memory as it flashes up at a moment of danger . . . . In every era the attempt must be made anew to wrest tradition away from a conformism that is about to overpower it . . . . Only that historian will have the gift of fanning the spark of hope in the past who is firmly convinced that *even the dead* will not be safe from the enemy if he wins. And this enemy has not ceased to be victorious.
>
> (1968/1955, 255)

For us the danger is that our being *of* as well as *in* the humanities remains an unanswered, even unasked, question. It is the predicament Steve Ramsay describes in *Reading Machines* (2011): the almost total grip of hermeneutical inhibitions on digital humanities, to the point of willful blindness to the centrality of interpretation. The primary historical object I want to bring into focus and call on for help with this predicament is the uncanny *otherness* of computing, its anomalous existential ambiguity. I will argue that the surviving evidence of fear this otherness once provoked, and continues occasionally to stir up, is a clue to a common ground with the humanities beyond utilitarian value or social impact.

But to avoid misunderstanding I must pause a moment to clarify what I mean by *fear*. The difficulty I have begins with a reluctance I think we share: to admit fear or attribute it to anyone whom we respect, in particular (given our profession) fear of computing. When the subject comes up, as it will in this lecture again and again, reluctance may bolster the common assumption that the emotions are natural or at least fixed psychological kinds and are an interference to, rather than component of, intelligence. In ordinary life we are wiser: thus the *Oxford English Dictionary* glosses the word as denoting 'all degrees of the emotion'[10] that (like the Devil) is known under so many names. I need the continuum this implies to be able to make sense of the historical actors and actions that are the focus of attention here, and so cannot risk the assumption that fear has an objective taxonomy of clear-cut and stable distinctions. It simply doesn't, as its history and current research in psychology demonstrate.[11] So in the following let us agree that *fear* has many guises, and—allow me to go out on a limb—that the presence of one degree of it does not preclude the presence, however hidden, of others.

I concentrate on fear rather than positive emotional response because dystopic visions of computing and reactions to them tell us far more about the psychological, intellectual and professional disruptions it brought about (see, for example, Hatfield 1928, 10). These were not just to the humanities and other technologically undereducated cohorts. The fearful threat of profound change was felt likewise in the sciences. Thus in the early 1970s the physicist Leon Kowarski,

writing about 'The Impact of Computers on Nuclear Science', expressed much the same existential and cognitive worries as did his humanist colleagues:

> The vision of these huge and costly machines . . . is in a way terrifying. The era of the ingenious scientist . . . seems to be past. The machine will have to run just 'because it is there', and according to its own rules. And from each run—there will be not much sense in calling them experiments any more—there will be a rich harvest of recorded data, like a deep-sea dredge . . . . There will be a lot of attempts to judge such new situations by old value criteria. What is a physicist? What is an experimenter? . . . Is the man who accumulates print-outs of solved equations a mathematical physicist? And the ultimate worry: are we not going to use computers as a substitute for thinking?[12]

Furthermore, I will argue, the fear this threat provoked, though negative, is more than simply negative: it is in fear's nature to fore-feel the unknown, the new, the anomalous, as I said, the uncanny.[13]

I begin where I will end, in the digital humanities, first by probing its professional literature. Then I will move outward in three stages, expanding the historical context as I go: first to daily life during the early period; then to the scientific programme from which computing arose; then very briefly (and *very* ambitiously) to an historical process that Agamben, with reference to our current preoccupation, calls the anthropological machine (2004/2002). I shall concentrate on literary computing to simplify, I hope not falsify, the bigger picture.

Shall we come rejoicing?

Allow me first to moralize a bit more, this time to advance the cause of acquisitive hunger for learning. This hunger is obviously one of my besetting sins. But I have a good reason for not repenting, despite good advice that I simply say what *I* think. In fact this *is* the way I think, by assembling scraps from other disciplines and making a kind of intellectual quilt suitable for our radically interdisciplinary and quite immature amalgam of interests.[14] Nelson Goodman has observed that quotation is a tool of worldmaking (1978, 56). We have a world to make.

Do you know the biblical story of Ruth the Moabite, of her gleaning in Boaz's field in order to feed her mother-in-law and herself? So, I say, are we: Ruth-like as a young discipline, migrants in need of the food of others, which is lying on the ground, that is, in libraries and online, freely for the taking, in seemingly endless and compelling abundance.

Make no mistake: we are *surrounded* by mature, subtle civilizations of enquiry, whose intellectual resources dwarf our own in volume, variety and sophistication. I think, for example, of philosopher Myles Burnyeat's 'Message from Heraclitus' (2012/1982) or of G. E. R. Lloyd's *Cognitive Variations* (2007; Inwood and McCarty 2010). I wonder, after catching my breath, when will *we* be able to write with such deep and far-reaching power? We may be smart, with the wind in our sails, but raw intellect alone and popularity aren't enough. Being in possession of our own

island of knowledge, autonomous, with our own agenda (when at last we have one), conferences and publications, all that is necessary *but not enough*. We need far more than the luck of the moment, dozens of sessions at the MLA, THATCamps everywhere, millions of tweets, thousands of blogs and so on and so forth. We need *resonance* with the intellectual cultures of the arts and humanities, just as a great organ needs an acoustically adequate space for its music to move the listener. (There, that's me, saying *exactly* what I think.)

We need the techno-sciences just as much, more than many of us realize, more than some of us fear. Scientism is a problem, but without the sciences we denature the technological side of our discipline by severing it from its epistemological roots. We turn our backs on a literature full of wonders, on intellectual excitement and real help. We need to understand, for example, the implications of introducing experiment—which is exactly what we do—into the humanities.[15] And we need to recognize the other 'styles of scientific reasoning', as Hacking has called them (2002), which have come into the humanities via the back door of computing (McCarty 2008).

We have much to learn from the technologically aware artists such as Stelarc[16] and Marcel-lí Antúnez Roca,[17] who are far less confused about the sciences than we seem to be. Both of them performed at the recent IEEE International Conference on Robotics and Automation, where a number of us spoke (please note: at the invitation of the roboticists) on 'Robotics and the Humanities'.[18] I was reminded of the 1968 *Cybernetic Serendipity* exhibition in London, at which artists and engineers experimented with ideas so far ahead of their time they remain mostly ahead of ours.[19]

We have much to learn as well from the scholar-writers with strong scientific interests, such as Gillian Beer, who works on Darwin (2009/1983); Laura Otis, on nineteenth-century technology (2001); and A. S. Byatt (2005, 2000), whose fascination with the sciences informs her fiction. And near at hand is the disciplinary bridge built by historians, philosophers and sociologists of science, opened to us in the early 1960s when, in Hacking's words, philosophers 'finally unwrapped the cadaver [they had made of science] and saw the remnants of an historical process of becoming and discovering' (1983, 1). To many of us, alas, there is *still* only the cadaver. Some hallucinate a zombie.

Where and what are we amidst all this abundance? Do we even know it exists? I've imagined us as maritime explorers in an archipelago of disciplines, peripatetic, prowling the margins; I've imagined us with the novelist David Malouf, adventurous youth discovering life and death in a wild, dangerous acre of bush (McCarty 2006); with Greg Dening, 'on the edge of things in a great ring of viewers' (1998, 183); with historian Peter Galison, in the trading zone (Gorman 2010), or as Dening says, on the 'beaches of the mind' (1998, 85–88). And this is why I am so pleased to have been named at Digital Humanities 2013 the 'Obi-Wan Kenobi of digital humanities':[20] to be honoured for the marginal, peripatetic life of learning I have been able to lead and continue, *deo volente*, to live with you.

I am pleased to have been considered, just for that moment now gone, an eremitic elder possessed of powers beyond the ordinary, kindly but serious and

not to be messed with. I am thrilled to be linked through Obi-Wan to Sir Alec Guinness, who made the part come alive (and had the good sense to shun the connection later). When Sir Alec was interviewed on the BBC Radio 4 programme *Desert Island Discs* in 1977, just prior to the release of *Star Wars*, he was asked what role he was playing in that film.[21] He answered, 'I don't know what I play—a wise old—an allegedly wise old character from outer space.' But however Obi-Wan'ish, I cannot agree to 'wise'; 'old' I will not admit to; and as far as I know, I came into the world in the way of all flesh and was raised in a small California town, though (I understand from the locals) flying saucers have been seen in the area.[22]

Courting catastrophe

But now back to Earth, to the present, to our world-building. The raw material is abundantly to hand. What do we do with it? What governs the design of our quilt?

After a talk at Cambridge in 2012 I was asked by the historian of ancient science Geoffrey Lloyd one of those questions I live to be asked: where would we be with our digital scholarship in 20 years? On what did I think our sights could be set most ambitiously? What I fumbled then to say I am still fumbling with, but here's another go.

I spoke earlier of computing's otherness—a more dramatic way of referring to the distancing effect Julia Flanders has gently called 'productive unease' (2009). She makes a strong case for the contribution of the digital humanities in foregrounding 'issues of how we model the sources we study, in such a way that [these issues] cannot be sidestepped' (2009, 22). I know this to be true from long experience unable to sidestep them. But what about those for whom digital resources are made, who aren't themselves makers? I know I'm not the first to find fault with principles of design that conceal the difficulties and provide no means of struggling with them. There are deep, tough questions here as to how and at what level the essential struggle is enacted. But Flanders's point remains: *the struggle is the point of it all*. And we do *not,* or should not, emerge from it unscathed! (Again and again I will insist on this: being scathed is paradoxically our salvation.) Love may be 'an ever-fixéd mark'; we humans aren't. If we are not changed in response to computing, we imprison ourselves with it.

This struggle is a nascent form of reasoning that we have done for millennia with tools. But the potential—here is the answer to Lloyd's question—is for reasoning to evolve in concert with a radically adaptive tool, something more than the steersman's tiller that inspired cybernetics,[23] less perhaps than a conversational partner—but almost that, or perhaps exactly that. As we get close to conversational machines, our attempts produce, in Robert Hughes's famous phrase, 'the shock of the new'.[24] We share with the roboticists the chance, in Warren McCulloch's words, to ride the shock wave by engaging deliberately with 'that miscegenation of Art and Science which begets inanimate objects that behave like living systems' (1968, 9). I call the result *catastrophic* in Stephen Jay Gould's evolutionary sense,

as that which punctuates the equilibrium of which we are a living part and so initiates developmental change.[25]

Such catastrophe implies a deep, not merely utilitarian, relationship between machine and human. Again the artists are there. In 1935 the Polish artist Bruno Schulz compared the work of art to a baby *in statu nascendi,* in the midst of being born, still operating 'at a premoral depth'. 'The role of art', he wrote, 'is to be a probe sunk into the nameless' (1998/1935, 368–70). What comes out is uncannily us and other, or to put it another way, an invitation to a becoming. So also for technologies. Those who attended the ACH-ALLC conference at Queen's in 1997 will have heard the Canadian cognitive psychologist Merlin Donald describe how from earliest times we have externalized ourselves in tools that have then remade us by changing what we can do, how we see the world and each other (Donald 1991). Thus the technological shape of early biocultural co-evolution in concert with material affordances, as Gary Tomlinson has argued for music (2013). Laura Otis, whom I mentioned earlier, has traced just such an interrelation of inventor and invention much closer to our own time in communication technologies and ideas of human neurophysiology from the mid-nineteenth century (Otis 2001).

In the twentieth century, computer and brain formed just such a co-developmental relation, or what Ian Hacking, in a very different context, calls 'looping effects' (1995): from Alan Turing's abstract machine in 1936, itself based on how a bureaucrat would do his sums,[26] to Warren McCulloch's and Walter Pitt's model of the brain as a Turing machine (1943); from their neurophysiological model to John von Neumann's computer architecture (1945), which he, inspired by McCulloch and Pitts, described in neurophysiological terms (Aspray 1990, 40, 180–81); and from that architecture to a modular conception of mind which reflected it (for example, Fodor 1983). Back and forth, back and forth. In 1948 von Neumann proposed that the problem of imitating natural intelligence might better be done 'with a network that will fit into the actual volume of the human brain' (1951, 34; 1958, 48). At the time of writing, the DARPA SyNAPSE program is working towards precisely that goal,[27] using neuromorphic hardware which reflects current ideas of neurological plasticity.[28] The pace of development is now so fast that neurophysiological models of consciousness and architectures of computing are a blurry chicken-and-egg. But that's precisely my point: the traffic between self-conception and invention goes in a loop. I want to ask what we can do to make that loop go for us and for the humanities.

Stalemate

Another bit of autobiography to get us there.

By the time I was done with *Humanities Computing*, McGann had come up with some powerful theories we might use to get us moving beyond the forecourts of interpretation, where from the perspective of the interpretative disciplines digital humanities had stalled early in its development.[29] Being stuck myself, I went for his gift basket of theories but could not see any rationale for choice. Since theories to some degree set forth the direction of future research and embody assumptions

about the world in which they operate, choice is crucial, the wrong choice potentially ruinous. To ask whether the research of a field should go in the direction expressed or implied by a theory, practitioners must have a good idea of where the field has been. They need history.[30]

I decided to focus on the history of what I will call the incunabular period, from a beginning in the late 1940s to the public release of the Web in 1991. I had two reasons: the period is neatly delimited, but more importantly it defines a time we have good cause to believe was formative.[31] This gave me confidence to think that despite the dramatic changes brought about by the Web, I could determine at least some parameters for a trajectory and so uncover a range of genuine possibilities for the future.

I found abundant raw material for such a history in the professional literature,[32] but constraints of time force me to give only the briefest sketch here.

Within the incunabular period the relevant literature in the Anglophone world defines a core of three decades, from the early 1960s to the early 1990s. These decades are bracketed by two pairs of evaluative statements. The authors of the first pair argued that the then-dominant use of computing to alleviate drudgery was skewing the focus of research towards problems of drudgery and away from imaginative exploration (Masterman 1962; Milic 1966). The authors of the second pair, summing up what had been done by 1991, argued that the field had failed in its ambitions, that its work had been steadfastly ignored by mainstream scholars because it was theory-poor (Potter 1991) or wrongly directed and should turn to what Franco Moretti was almost a decade later to call 'distant reading' (Olsen 1991).[33] During those three decades Busa was among the very few who insisted that the point was not saving labour but 'more human work, more mental effort . . . to know, more systematically, deeper, and better' (1976, 3). Few insisted along with him that the point was not to design for efficient service but to realize that computing was something altogether new and to find out what that was. The brilliant experiments of cybernetic artists to which I referred earlier, not just in London but also in Zagreb, Paris, New York, Sydney and elsewhere, gave glimpses of what could be done with very little. Thus the poignancy of Busa's question in 1976 on behalf of philology: 'Why can a computer do so little?'

From his analytic, philological perspective Busa pointed to the sophistication of human language. His response serves well to explain why the pioneering work in computational stylistics, first by John Burrows, then also Hugh Craig, David Hoover, Tomoji Tabata, Jan Rybicki and others, and now for literary history by Matt Jockers (2013) and former colleagues at the Stanford LitLab,[34] has been long in the oven. It is the great exception to the stalemate that concerns me here. It is exceptional, and really should rock our colleagues, because it has produced 'mounting evidence', as Burrows has said, that literature is probabilistic—hence that the most elusive of cultural qualities behaves in roughly the same way as both the natural and social worlds.[35] But the cause of this work's obscurity to most of us—fear of the mathematical—returns us to the stalemate that concerns me here. What is it about numbers that frightens us away? What are we frightened of? What does this fright tell us about our relationship to digital machinery?

Let me work towards an answer by revising Busa's question: not why can the computer do so little, but why were those historical scholars doing so little with it? What was stopping or inhibiting them? We know, thanks to the cybernetic artists, that primitive kit cannot be blamed and that the kit itself had as much or more potential to inspire and excite creative work as it did to inhibit. We know from those who experimented that the concerns of the humanities were a fertile ground for experiment with computing.[36] We know that at the time a few saw what was not being done and were distressed.

As the evidence shows,[37] computer-using scholars commonly worried about lack of progress and its causes. Blame for the problem was variously fixed. But what matters historically and tells us far more of use to us now is not the causes they assigned but the fact of their persistent worrying, repeatedly, from the early 1960s on. Sensitivity to this fact foregrounds the anomalous expressions of concern about computing not merely in the professional literature of digital humanities but scattered all across the academic and popular writings of the time. However directed to whatever subject, these expressions of concern looked to an unknown future with varying degrees of predictive assertiveness and disquiet. Then as now the popular press exaggerated both, and by doing that showed that a nerve had been touched.[38] It is easy for the knowledgeable practitioner to dismiss such reactions, as Parrish did in 1962 when he scorned the fearful who, he alleged, were indulging themselves 'with terrors that are meaningless to people who know anything about computers' (1962, 2). But as I have suggested, even techno-scientific competence was no shield to the important and significant fear of the computer becoming human. Supposed evidence, formed as such in no small measure by thinking of the human in computational terms, made this becoming seem inevitable.

In an old but still valuable 'synthetic genetic study' of fear, pioneering child psychologist G. Stanley Hall wrote that the emotion is 'not prevision but only a highly generalized fore-feeling . . . a primitive *Anlage* of futurity' (1914, 149). I quote him not merely to underscore congruence between two forward-looking kinds of imaginative activity, computing (by design) and fear (by nature). Rather, as I suggested earlier, I want to complete my rescue of the emotion from dismissal as only, purely negative, therefore unhelpful. Thus his crucial point for my purposes: 'but for fear pain could do little of its prodigious educative work in the animal world. Fear is thus . . . *the chief spur of psychic evolution*' (my emph.). I will return to human psychic evolution later. For now let us agree that fear is a treasure to the historian, if a mixed blessing to those afflicted.

Fear was variously expressed in the professional literature of digital humanities: fear of the distortions computing would work on the humanities if taken seriously, evinced by the work and words of those who did take it seriously;[39] fear of its mechanization of scholarship,[40] parallel to the mechanization of which public intellectuals had been warning;[41] fear of its revolutionary force, threatening to cast aside old-fashioned ways of thinking, as literary scholar Stephen Parrish declared was about to happen;[42] and fear expressed in reassurances, such as literary critic Alan Markman's, that the computer is no threat to scholarship or a dehumanizing

machine to be feared (1965, 79), or historian Franklin Pegues' in a review of the conference at which Parrish spoke, that all would be well, that the scholar still had a role to play and would not be put out of work (1965, 107). It was fundamentally an existential angst, a 'fear and trembling', as one scholar said (Nold 1975), quoting Søren Kirkegaard.

How do we explain such evidence? Here is where the harder task of history-writing begins, in the first of the two dilations I promised earlier: outward from the professional literature, heavily filtered by academic decorum, into the social setting in which our predecessors lived. Blaming (as some have done) a bogey-man of their particular disliking—French critical theory is a favourite among empiricists—only grants it causal powers it did not have.[43] All were part of the same world. What was that world like? Our predecessors were ordinary people as we are, living more or less ordinary lives. What was ordinary life like for them?

Readings can be taken in various ways, for example from imaginative literature of the time, including science fiction, or from the cinema. Best for my purposes are the ambient bearers of information we can plausibly assume ordinary people, including academics, would have encountered casually, accidentally in daily life: newspapers and magazines, neighbours, shopkeepers, radio and television. The abundance I must skip over is painful to omit, as it conjures the scene so effectively. Let me recommend that you seek out a few images that the complications of copyright and expense of reproduction prevent me from offering you: some utopic, some dystopic, with which the media were then saturated.[44] First the utopic: the computer depicted in *Saturday Evening Post* for 16 December 1950 in an advert, 'Oracle on 57th Street', showing a giant Sibylline figure sitting atop IBM World Headquarters in Manhattan, a scroll of printout tumbling from her outstretched arms; the computer as 'giant brain' (a viral phrase at the time) in Boris Artzybasheff's *Time Magazine* cover for 2 April 1965; the computer, shown on the scale of the room-sized ENIAC, ejecting a greeting card with a red heart on it for the operator, a woman alone in the room, on the cover of *The New Yorker*'s Valentine's Day issue, 11 February 1961; and, in a Marvel Comic advert, a child's toy, 'miracle of the modern space age . . . . an actual working digital computer' designed and marketed by Edmund Callis Berkeley, author of *Giant Brains, or Machines that Think* (1949). Then the opposite of these: a photograph of the darkened control room of the Semi-Automatic Ground Environment (SAGE) system with the Whirlwind computer at its core, in effect a giant military cyborg for defence of the United States against nuclear attack, fictionalized in *War Games* (1983);[45] the computer on the cover of *Processed World* 12 (1984) as hydra-like PC automator of office work attacking a woman at her desk with its many tentacles while her boss looks on; a looming mainframe tape drive in an advert for the Electronic Computer Programming Institute, in the *Pittsburgh Press* for 6 November 1966, proclaiming 'Let this machine give you a new career before it takes away your old one'; and finally a photograph of a woman inside a mainframe, looking startled, accompanying an article by Warren R. Young in *Life Magazine* for 3 March 1961: 'The Machines Are Taking Over. Computers outdo man at his work now—and soon may outthink him.' Such images and sentiments were commonplace.

Granted: neither emotional extreme, jubilation or terror, were at all likely to have been observed in persons who viewed these images. What seems more likely would have been the feeling expressed in 1969 by the director of an intensive summer programme for disadvantaged students at Harvard, Yale and Columbia, Gordon K. Davies, who expressed 'the most typical anxiety concerning man's relation to computers': the fear of oneself being reduced to data processing cards. He wrote, 'we must be careful, or we shall all become rectangles of cardboard with holes punched in them' (Davies 1969, 283).

All of this, whether at home or at work, was enframed and informed by the defining context of computing in its infancy, the Cold War—so named by George Orwell two months after the atom bomb was dropped on Nagasaki, 9 August 1945.[46] Again, forced to be briefer than I would like, I offer another sampling of material typical of the time: a vividly illustrated *Life Magazine* article of 1950 based on a plan for survival of nuclear attack, hatched by Norbert Wiener and two colleagues from the History Department at MIT, with reference to the contemporary British film *Seven Days to Noon* (LM 1950); a 1961 article in *Reader's Digest* reporting on the widely publicized near miss of 5 October 1960, when an incorrect software model caused the rising moon to be falsely identified as a massive Soviet missile attack;[47] a paper in 1985 for the Symposium on Unintentional Nuclear War, in which Brian Cantwell Smith demonstrated that in principle no fool-proof system was possible—that there would always be another such moon-rise, as he said.[48] Children on both sides of the Atlantic (I, like historian Spencer Weart, was one of these) practiced variants of 'duck and cover', diving under desks in school to be ready for the bomb;[49] adults were instructed via Civil Defense bulletins and films.[50] Stanley Kubrick's *Dr Strangelove* (1964) told a story we recognized because we were almost living it.

What the thunder said

What do we make of all this?

First the obvious: that the Cold War gives us a good if partial explanation for scholars' timidity in the real or imagined presence of mainframe systems that were *other* to most humanists because physically, culturally alien and obviously complicit. But it also helps to explain the curious departure of the scholarly mainstream from the kinds of enquiry computing was most nearly suited for just at the time when computers became available.[51] Anthony Kenny has speculated that the majority turned away from computing to critical theory in fear of quantification (1992, 9–10). There's truth to that guess, just as there is reason behind practitioners' opposition to abstract theory, but both underplay the positive, indeed visionary hunger for theorizing as a liberating practice (for example, Hooks 1994, 59). Students were, as one said, *theory-hungry* (Bowlby 2013, 32). The evidence suggests that they and their theorizing professors did not so much flee from computing as run towards and embrace new, powerful means of asking (in Terry Eagleton's words) 'the most embarrassingly general and fundamental questions, regarding [routine social practices] with a

wondering estrangement which we . . . have forgotten'.[52] The mechanizers had nothing for them.

The public release of the Web in 1991, coinciding almost exactly with the end of the Cold War, was a radical game changer.[53] But as others have remarked, the Web did not address the stalemate in analytical computing, rather it shifted attention to the great stocking of the virtual shelves. The Web buried the problem rather than solved it, and by being so very useful and saleable to colleagues, Web-based resources did little to bring our discipline in from the cold intellectually.

Hence, with the thrusting of digital humanities into the limelight, the old complaints and problems have resurfaced unresolved: first, the internal relation of theorizing to making, and of scholarship to technical skills; second, the external relation of digital practices to the techno-sciences on the one hand and to the non-technical humanities on the other; third, the still unknown basis for a 'normal discourse' (Rorty 1979, 320) that would allow us to speak coherently to each other and to others. Alan Liu (2011) and Fred Gibbs (2011) have both asked the question I am struggling here to answer: where is the criticism in the digital humanities? Where indeed? The danger is temptation 'to trope away from specificity and to generalize hyperbolically . . . through an extremely abstract mode of discourse that may at times serve as a surrogate' for experience (LaCapra 1998, 23). Ungrounded theorizing is as much an enemy as no theorizing at all. But the absence Liu and Gibbs illumine is the theoretical poverty I spoke of at the beginning. It was noted at the end of the incunabular period by Rosanne Potter in her survey of previous work (1991). This poverty vexes us still. It may seem with all the activity we are witnessing, so much we cannot see it all, that the long-awaited revolution has begun (Jockers 2013, 3–4). But actually it's been proclaimed before—e.g., by literary critic Stephen Parrish at the first conference in the field in 1964[54]—but then 'postponed owing to technical difficulties' (Mahoney 2011, 56). The truth is that the great cognitive revolution for us has not begun even once. Natalia Cecire is right on when she argues that for humanities *plus* computing the central problematic—Bachelard's 'matrix or angle from which it will become possible and even necessary to formulate a certain number of precise problems' (Maniglier 2012)—is that *plus*; so far, as she says, we've construed the joining to be merely additive rather than transformative (Cecire 2011, 55). The growing mass of well-presented data is continuing to change conditions of scholarly work, and with them (I suspect) much else, but this is *not* addressing the old problem of how we are *of* the humanities. It does not help us with what that *plus* means, what it portends, what it entails.

That's why I've embarked on a history of the present. Such a history demands use of the past to point the way forward. If long ago scholars came to the crossroads, to that plus sign, and were frightened either into retreating or into reducing the challenges of the machine to something comfortable, like minimizing drudgery or mining data; if we find now that we are still there wondering what to do analytically but cannot, despite healthy scepticism, shake the sense that what we know to do is only a poor beginning; then that old fright is a treasure to be *used*, not just understood. It directs us to the uncanny moment; what

matters is our response to it, as Benjamin said. What matters is our trajectory into the future.

When Father Busa asked why the computer could do 'so little' for philology, he meant in relation to the 'monumental services' done elsewhere, especially in the sciences. In the mid-1960s, in artificial intelligence, machine translation and humanities computing, the honeymoon period came almost simultaneously to an end.[55] All three suffered 'notorious disappointments', as Cambridge Lucasian Professor Sir James Lighthill said of machine translation in 1972 (Lighthill 1973/1972, 10). His sentence for AI can stand for them all: 'In no part of the field have the discoveries made so far produced the major impact that was then promised'.[56] (8). But note: AI absorbed the shock and continued; computational linguistics was born out of machine translation and thrived; digital humanities, as a theoretical, critically self-aware and persuasive discipline, remained *in potentia*.[57] Changing the name from 'humanities computing' and being popular with the boys and girls does not solve the fundamental problem.

And so my second dilation: from the social world of digital humanists circa 1949–91, to the world from which digital computing arose, that of the technosciences, first as we know them now, then as they have been since Bacon and Galileo.

The extent of computing's influence on these sciences is unabashedly summarized by philosopher Paul Humphreys in his book *Extending Ourselves: Computational Science, Empiricism, and Scientific Method* (2004).[58] Because of computing, Humphreys observes, 'scientific epistemology is no longer human epistemology' (2004, 8). He concludes in language reminiscent of Milton's *Paradise Lost*: 'The Copernican Revolution first removed humans from their position at the center of the physical universe, and science has now driven humans from the center of the epistemological universe.'[59] Whether he is right is for my purposes beside the point. What matters is his language, specifically his echo of Adam and Eve's expulsion from Paradise.[60] What's going on?

The best known and most fruitful pronouncement of the kind is Sigmund Freud's. Twice in 1917 he declared that scientific research had precipitated three great crises in human self-conception, or as he put it, three 'great outrages' ('große Kränkungen'):[61] first, as with Humphreys, by Copernican cosmology, which decentred humankind; then by Darwinian evolution, which dethroned us, setting in motion discoveries of how intimately we belong to life; and finally by his own psychoanalysis, which showed we are not even masters of own minds. Less often noticed is his suggestion (implicit in the German *Kränkung*, from *krank*, 'ill, sick, diseased') that these dis-easings of mind can be turned to therapeutic effect. We are apt to see only the physician here, but Freud was in fact showing his inheritance from the whole moral tradition of the physical sciences. At least from Bacon and Galileo in the seventeenth century this tradition had identified the cognitively and morally curative function of science acting against fanciful or capricious knowledge—'the sciences as one would', Bacon called it.[62] Science for them was a corrective, restorative force: 'the moral enterprise of freedom for the enquiring mind', historian Alastair Crombie has written.[63] We now know that

in its origins science was not anti-religious; its aim was restoration of cognitively diseased humankind to prelapsarian Adamic intelligence (McCarty 2012a, 9–11). The religious language has gone from science (with the occasional exception, as we have seen), but the moral imperative remains. Freud's series of outrages is thus radically incomplete: they do not stop with him because the imperative to correct 'the sciences as one would' is integral to the scientific programme.

But the high moral purpose darkens when the scientific perspective is taken to be absolute, reducing human imaginings to narcissism on a cosmic scale. Consider, for example, cosmologist and Nobel Laureate Steven Weinberg, who like Freud takes aim at this narcissism, proclaiming that we live in 'an overwhelmingly hostile universe' whose laws are 'as impersonal and free of human values as the laws of arithmetic', 'that human life is . . . a more-or-less farcical outcome of a chain of accidents reaching back to the first three minutes' after the Big Bang.[64] Or consider the words of geneticist and Nobel Laureate Jacques Monod, who aims at the same target, proclaiming 'that, like a gypsy, [man] lives on the boundary of an alien world that is deaf to his music, and as indifferent to his hopes as it is to his suffering or his crimes'.[65] A Blakean Nobodaddy is in the pulpit, gleefully telling us deluded children to grow up and face facts. However severe Weinberg and Monod may be, they are indicative of a much broader sense of a mounting attack of ourselves as scientists upon ourselves as humans, summed up by biological anthropologist Melvin Konner: 'It would seem', he concludes, 'that we are sorted to a pulp, caught in a vise made, on the one side, of the increasing power of evolutionary biology . . . and, on the other, of the relentless duplication of human mental faculties by increasingly subtle and complex machines.' He asks, 'So what is left of us?' (1991, 120).

This question and the vision it encapsulates lie close to the recent origins of the so-called posthuman condition, which is likewise both feared and celebrated by cultural critics as the end to the old conception of humanity.[66] I will return to it in a moment. But note: doesn't Konner's question sound familiar? Isn't it formally the same question that Flanders's encoder constantly asks, mindful of the 'productive unease' from which she struggles to learn? Isn't it the same question Jerry McGann has illumined by that reach for the 'hem of a quantum garment' when all else but the inexplicable anomaly has been nailed down? Again: the claustrophobia which signals a world outgrown and a transformed one in the offing, a catastrophe which punctuates the old equilibrium, precipitating a new order of things, a new idea of the human.

The cultural criticism that Alan Liu says we lack converges on much the same crisis of the human as the sciences (though it does not spare them). 'A good many theorizations of the postmodern', Hans Bertens writes, 'suggest that for some time now we have been finding ourselves in the middle of a moral, political and cognitive mohole'—Don DeLillo's fictional cosmic zone where physical law is suspended—'and, indeed, may never get out on the other side' (1995, 230). The question is again, what is left of and for us?

And so to my third dilation, ambitious in the extreme, as I warned, but promising so much. Here I can only indicate where I think it takes us.

I have argued that we are situated at the posthumanizing juncture where computing meets the humanities and so replicates the larger cultural transformation expressed in and through Turing's machine. But the historical *longue durée* of becoming human shows this juncture to be one of many punctuating catastrophes. This is the story told for example by Roger Smith in *Being Human: Historical Knowledge and the Creation of Human Nature* (2007). It is the process sketched across the millennia by Giorgio Agamben in *The Open: Man and Animal* (2004/2002), in which he cites Carolus Linnaeus's eighteenth-century classification of us as human by virtue of our perpetually coming to know ourselves, *homo nosce te ipsum*. And, at the other end of the scale, is our every moment's 'going on being' in the anxious construction of self that Anthony Giddens brilliantly describes in *Modernity and Self-Identity* (1991). This same anxiety is legible in the attempts, such as René Descartes's in 1637, to counteract perhaps the most psychologically corrosive discovery of his age, the Great Apes, so physiologically similar to humans, physician Nicolaes Tulp wrote in 1641, 'that it would be difficult to find one egg more like another'.[67] There is, I think, no more powerful expression of this anxiety than Jonathan Swift's depiction of Lemuel Gulliver driven insane after willingly embracing the lustful, brutish nature he had denied was his, in the form of a female Yahoo in heat. Ejected by the creatures of perfect reason for copulating with her and so revealing what he is, he returns home to find himself repelled by the smell of 'that odious animal' his wife, preferring the company and smell of his horses and of the groom who takes care of them.[68]

Marvin Minsky reminds us that in making any model of what's happening (as we do when we speak of a crossroads or plus sign) we must never forget that the modelling relation is terniary, in other words that our plus sign is three dimensional, that it signifies nothing independently of us:[69] we are individually, personally, morally, psychologically involved. We are *attacked*, as Lionel Trilling said, by forces we would be foolish to underestimate (1967/1961). But for us the catastrophic attack is no longer animal. Our digital machine has shifted the locus of engagement.

In 1970 the Japanese roboticist Masahiro Mori (whom I mentioned earlier) proposed that as robots become more recognizably anthropomorphic, we react more favourably to them, until suddenly their resemblance to us becomes uncanny and so provokes a strongly negative reaction. He called this plunge into fright 'the uncanny valley phenomenon' (Mori 2012/1970). Then and in a recent interview Mori has emphasized the benefit of remaining deliberately in the uncanny valley, so as better to know what it means to be human (Kageki 2012). Those of you who have seen the Bollywood film *Enthiran* (2010), Spanish *Eva* (2011), the Swedish *Äkta Människor* ('Real Humans' 2012) or 'Be Right Back' from the British *Black Mirror* (2013) will know how current in our thoughts this valley remains. For us in digital humanities the locus of engagement may well be—I think it must be—with the embodied artificial intelligence of robots. But my point for now is the uncanny valley which that plus sign denotes.

This valley is our place of beginnings. All disciplines are that, of course—starting points for a mental expanding that is transgressive but not possessive. 'It doesn't

matter so much what you learn', Northrop Frye wrote in *On Education*, 'when you learn it in a structure that can expand into other structures' (1988, 10). Our structure is the crossroads of the techno-scientific and the humanistic. That's where we begin, whether we mine individually for diamonds or collaboratively for coal (Kowarski 1972, 29).

The unknown, remembered gate

So, how do we get there? What do we do about the situation I have depicted?

'Turing's "Machines" . . . ', Wittgenstein wrote in the mid to late 1940s, 'are *humans* who calculate' (1980, 191e §1096), and that's exactly what we find when we go back to Turing's paper of 1936, his originating metaphor of 'a man in the process of computing a real number'. So we find ourselves reduced to a 'computer' (as that man would then have been called, and as we now call the device he became). In it we discover a bare-bones stamp of the human that can do so much that is so little. Again, Fr Busa asked, why can it do so little? Now, I suggest, we must ask, how is all that it can do, and all that is imagined it will do, still so little? Or better: how do we come to know, however able it becomes, that it *is* so little? If it isn't, how do we make it so?

These are the questions that constitute the next step towards a digital practice that is *of* as well as *in* the humanities. This next step is the learned practitioner's open-eyed, technologically informed, imaginative, critical, hands-on *questioning* of what happens at the crossroads of actual work, where computing, scholar-practitioners and the humanities meet. It opens up the shocking yet familiar otherness that is rough midwife to ourselves as will be. It *defamiliarizes,* as Viktor Shklovsky said, so to recover 'the sensation of things as they are perceived and not as they are known' (1965/1917, 12). And while all that is going on, digital humanities needs use its more than 60 years of fumbling to gain leverage for a great inductive leap to a vantage point from which its disciplinary shape and trajectory, sighted dimly here, can be clearly seen. The key to its future—and in some measure the future of all the related humanities—is its history. This history we must remember.

Remember: not a tablet fetched from a storehouse just as it was written—a metaphor from classical antiquity that found at last a fitting referent in digital computing machinery—rather the creative, storytelling activity we now know it to be. I leave you with this: remembrance of what our predecessors did and did not do, and the conditions under which they worked, so that we may fashion stories for our future and the language in which to tell them. Remember that the struggle is the point of it all. Remember the humanities.

Notes

1. The Busa Award lecture was presented at the 2013 conference of the Alliance of Digital Humanities Organizations, Lincoln, Nebraska, 16–19 July, for which see dh2013.unl.edu/. For the lecture as delivered see www.youtube.com/watch?v=nTHa1rDR680.

2. For the autobiographical thread of this lecture my model is the inspirational American Council of Learned Societies' Charles Homer Haskins lecture series, 'A Life of Learning', www.acls.org/pubs/haskins/.
3. Henceforth, to indicate the essential continuity (not identity) for which I am arguing, I will use the term 'digital humanities' for the activity from 1949 to the present. To dismiss the earlier period as somehow essentially different and so irrelevant is a serious, damaging error. As Agamben said, quoting Deleuze, 'terminology is the poetic moment of thought' (2009, 1).
4. The final state of *An Analytical Onomasticon to the* Metamorphoses *of Ovid* is preserved at www.mccarty.org.uk/analyticalonomasticon/.
5. I owe a great debt of gratitude to two in particular: Burton Wright at Toronto for his persistent other-mindedness, and Monica Matthews at King's College London.
6. See www.dhhumanist.org/.
7. 'Introduction to Perek Helek', on his 13 principles of faith. The Hebrew is thanks to Ms Debora Matos; the translation is taken from the Maimonides Heritage Center's version at www.mhcny.org/qt/1005.pdf.
8. This is a serious qualification and represents, I think, a new departure for the humanities. See especially Gooding 1990; Galison 1987; see also McCarty 2008.
9. Hacking 2002, 202; compare with 70, 71.
10. *OED* n.1, 2.a.
11. Distinctions, for example between fear and anxiety, are unclear (Bourke 2005, 189–92) except in quite specific circumstances, for example for psychiatric diagnosis (DSM-5 2013 makes *anxiety* the standard term). Note also that categories of emotion are not only blurred but also historically contingent: see, for example, Plamper 2012; Eustace et al. 2012; and compare with Danziger 2008. For general studies of fear see Plamper and Lazier 2012; Dyer et al. 2008; Bourke 2005; Hollander 2004; Massumi 1993; Gray 1991; Hall 1914. Fear of computer technology is well documented in psychology (for example Bozionelos 2001, Brosnan 1998 and many earlier), postmodern and posthuman studies (Dinello 2005; Hayles 1999), for automation (Zuboff 1988) and elsewhere. Fear has been a constant companion of AI (McCorduck 2004/1979) and, of course, robotics (Mori 2012/1970; Kageki 2012), to which I will return. For the arts, humanities and librarianship see Kohrman 2003; Holland and Burgess 1992; Kenny 1992; Nold 1975; Daigon 1969; Efron 1966; Pegues 1965; Handlin 1964; Brower 1964; Jenkins 1962; Parrish 1962; Schofield 1962. See also note 27, below.
12. Kowarski 1972, 38 and 1975; see also Aborn 1988 and Denning 1986; compare with Galison 1996, 139–40.
13. For the uncanny in the context of recent automata, see Galison 1994, 242–43 on Norbert Wiener's wartime research, with reference to Cavell 1988/1986 on Freud's analysis of E. A. Hoffmann's *Der Sandmann* (Freud 1955/1919); see also Mori 2012/1970 and Kageki 2012, discussed below. For more recent work see Masschelein 2011.
14. Such quilt-making, at least in the preliminary stages of research, would seem to be a default condition nowadays. See Richard Rorty's exploration with reference to Gadamer (Rorty 2004), for what I've called going wide rather than deep, that is, doing what we do as researchers in a fundamentally different way (McCarty 2013). The dangers are, I think, both non-trivial and obvious.
15. See note 8.
16. See stelarc.org. For a discussion of his work see Massumi 2002, 89–132.
17. See marceliantunez.com/.
18. See www.icra2013.org/?page_id=1272.
19. Reichardt 1969; see also Brett 1968; Klütsch 2005; Fernández 2008. For cybernetic art as a whole see Brown et al. 2008; Shanken 2002; Reichardt 1971; for larger contexts see Apter 1969; Malina 1989; Husbands, Holland and Weaver 2008; Gere 2008, 51–115; Pickering 2010.

20. Matthew Jockers has told the sort of my *creation* (*OED* 'create', 2.a.) as Obi-Wan in his blog entry for 19 July, at www.matthewjockers.net/2013/07/19/obi-wan-mccarty/; for the background see Glen Worthey's blog at digitalhumanities.stanford.edu/obi-wan-mccarty-episode-1.
21. www.bbc.co.uk/radio4/features/desert-island-discs/castaway/204bd479#p009mszc.
22. See, for example, www.youtube.com/watch?v=_RI99bG_-6A and www.youtube.com/watch?v=9FqoOvUymfE, both sightings close to my place of birth.
23. Wiener 1961/1948, 7; compare with Hutchins 1995; Menary 2010.
24. Hughes 1991/1980; compare with the essays in Herbert 2000/1964 for the supporting words of the artists themselves and Shlovsky 1965/1917.
25. The theory from which evolutionary catastrophe comes is 'punctuated equilibrium', first proposed by Gould and Eldridge 1977. Note Gould's later synopsis: 'The history of life is not a continuum of development, but a record punctuated by brief, sometimes geologically instantaneous, episodes of mass extinction and subsequent diversification' (1989, 54). See also Eldredge's cautionary remarks on the use of the evolutionary metaphor outside the biological sciences (Eldredge 2009).
26. 'We may compare a man in the process of computing a real number to a machine which is only capable of a finite number of conditions . . . ' (Turing 1936–1937, 59, 49). Note the relationship of Turing's machine and its progeny to governmental bureaucracy in Agar 2003.
27. See www.artificialbrains.com/darpa-synapse-program (visited on 5 April 2013).
28. As the editors of *Critical Neuroscience* note in their Introduction, 'Evidence of genomic and neural plasticity . . . forces scientists to rethink the primacy given to biophysical levels of explanations, and challenges us to destabilize the dichotomy of nature/culture and instead address the fundamental interaction of mind, body, and society' (Choudhury and Slaby 2012, 34); see also the contributions throughout this volume and Pascual-Leone et al. 2005, Buonomano and Merzenich 1998.
29. McGann 2004. Stalled development is attested from the early 1960s by a mixture of (a) persistent nervousness over 'evidence of value', as the test of worth was later to be called (McCarty 2012b, 118), and inability to demonstrate any such evidence persuasively; (b) closely related agonizing over lack of influence on mainstream disciplines; and (c) preoccupation with the menial applications of computing, and so failure to deal with the theoretical problem of a digital hermeneutics. To 1991 the best state-of-the-art summary (of literary computing) is Potter 1991; see also Masterman 1962; Fogel 1964; Busa 1976 and 1980; Corns 1986; Zwaan 1987; Irizarry 1988; Potter 1989; DeRose et al. 1990; Corns 1991; Olsen 1991. Subsequently see the retrospective studies by Kenny 1992; Fortier et al. 1993; Miall 1995; McGann 2001; Ramsay et al. 2003; Rommel 2004; McGann 2004; Hoover 2007; Juola 2008; McCarty 2008; Ramsay 2011; McCarty 2012a; Jockers 2013.
30. The most recent attempts, Hockey 2004 and the other contributions to Schreibman, Siemens and Unsworth 2004, Part I, 'History', are but first steps toward a genuine history; see White 1980 on the distinction between chronology and history. For the dimensions of the problem of writing a history of computing, see Mahoney 2011, especially 'The Histories of Computing(s)', 55–73; for the importance of history to the formation of a discipline see Frye 1957, 15.
31. On the formative effects of early developments in social institutions see Stinchcombe 1965; Baum and Singh 1994, 12 and under the heading 'imprinting'; compare with Lounsbury and Ventresca 2002; Tillyard 1958, 11–12.
32. See, for example, the references in note 29.
33. For the revised and published version of Olsen 1991 see Olsen 1993 and note Fortier's introductory remarks in Fortier 1993. For 'distant reading' see Moretti 2000; Bode and Dixon 2009; Bode 2012; Jockers 2013.
34. See the series of pamphlets at http://litlab.stanford.edu/?page_id=255, and compare with Liu 2013.

35. Burrows 2010. On statistics across the disciplines see Gigerenzer et al. 1989; Hacking 1990; see also Hacking 1995.
36. Automated poetry writing seems to have made the biggest stir, but experiments in the other creative arts should not be ignored (for which see note 19, above). For poetry, see Funkhouser 2007; also 1971; Masterman and McKinnon Wood 1970; 'Computer poems and texts' in Reichardt 1969, 53–62, including Scottish national poet Edwin Morgan's 'Note on simulated computer poems'. We can be reasonably certain from his language that F. R. Leavis's violent objections to the very idea of computer-generated poetry (Leavis 1970) were aimed at Masterman; they betray just the kind of underlying fear I have been arguing for, though Leavis was also quite prescient. See Oliphant 1961–62; Newell 1983; Ernst 1992; Van Dyke 1993. Compare with Weaver 1961; Nemerov 1967.
37. See note 29.
38. For example the weekly magazine *U.S. News and World Report*, which in a pair of articles for 24 February 1964, 'Is the Computer Running Wild?' and 'Machines Smarter than Men?' (an interview with Norbert Wiener) hinted at if not predicted a very dark future (USN&WR 1964a and b).
39. Kenny 1992, 9; McKenzie 1991, 161; Banz 1990, 28; Mesthene 1969; Milic 1966.
40. Prescott 1999, 73; Mitchell 1967, 22–23; Lindsay 1966, 28; Hymes 1965. Mechanization of scholarship also occurs in highly positive contexts, however, for example in the first six contributions to TLS 1962; note Margaret Masterman's serious objections in that volume (Masterman 1962).
41. Purdy 1984; Leavis 1970; McDermott 1969; Mumford 1967 and 1970a, 1970b; Pooley 1961; Ellul 1964/1954; Wiener 1954/1950, 136–62. Compare with Husbands, Holland and Wheeler 2008; Morgan 2006, 11–31; Agar 2003; Zuboff 1988; Giedion 1948.
42. Parrish 1964; note commentary by Pegues 1965.
43. An example is Hoover 2007; compare with Miller 1991.
44. Some glimpse of these may be obtained from YouTube, http://www.youtube.com/watch?v=nTHa1rDR680.
45. See especially Edwards 1996 and note LM 1957; Ghamari-Tabrizi 2000.
46. Orwell 1968/1945, 9. On the Cold War see Ball 2004/1998; Whitfield 1996; Hennessy 2002; Grant 2010; Kahn 2007/1960; Leffler and Painter 1994.
47. Hubbell 1961. According to MacKenzie 2001, 340 no. 4, this remains 'the best available account of the incident'. For others see Borning 1987; www.nuclearinfo.org/.
48. Smith 1985, rpt. Johnson and Nissenbaum 1995, 456–69; compare with Shore 1985, 161–84 on 'Myths of Correctness'; see also Dyer 1985, reporting on the conference at which Smith 1985 was given.
49. The phrase 'duck and cover' refers to the 1952 film of that title (www.imdb.com/title/tt0213381/fullcredits); for an early draft of the script see www.scribd.com/doc/45799687/Duck-and-Cover-Script. See Weart 1988; Brown 1988; McEnaney 2000; Masco 2009; www.conelrad.com/.
50. For example for the UK see HMSO 1963; for the United States see OCD 1968; see also the Civil Defense Museum's collection, www.civildefensemuseum.com/docs.html. The Internet Archive and YouTube are rich sources for the many instructional films produced in both countries.
51. Connor 1991, 58–59 observes this curiosity for Classics, but it is true for literary studies as a whole; see Kenny 1992, 9–10, who cites Connor.
52. Eagleton 1990, 34. See also Hooks 1990 and the work of Raymond Williams and Richard Hoggart during the incunabular years.
53. The Berlin Wall fell 9 November 1989; the Soviet Union was officially dissolved by the signing of the Belavezha Accords 8 December 1991. Tim Berners-Lee proposed what later became the World Wide Web in March 1989; the Web was released to the public, on alt.hypertext, 7 August 1991.
54. Parrish, who had attended C. P. Snow's 'Two Cultures' lecture in 1959 and had sided with the scientists, declared a consensus, 'that we understand ourselves to be living though the early stages of a revolution, perhaps a quasi-scientific revolution, which cannot fail

to touch us all in everything we do' (1964, 3–4). For the 1964 conference see Bessinger, Parrish and Arader 1964; Pegues 1965.

55. For machine translation see ALPAC 1966; for artificial intelligence see Dreyfus 1965; for digital humanities see Milic 1966. There were prior difficulties for all three, but it is interesting that prominent public declarations or accusations of failure occurred in the United States almost simultaneously.
56. Lighthill 1973/1972, 8, 10. See also 'Controversy: The General Purpose Robot is a Mirage' ('The Lighthill Debate', YouTube, in six parts), pitting Lighthill in debate against Donald Michie (Edinburgh), John McCarthy (Stanford) and Richard Gregory (Bristol).
57. For a summary form of the argument for this statement see note 29.
58. Compare with Humphreys 2009; see also Lenhard 2007.
59. Humphreys 2004, 156. Mahoney shows that it is possible to avoid the apocalyptic, biblical language: 'the artefact as formal (mathematical) system has become deeply embedded in the natural world, and it is not clear how one would go about re-establishing traditional epistemological boundaries among the elements of our understanding' (2011, 179).
60. On this sort of language see especially Keller 1991 and Midgley 2002/1989.
61. Freud 1920/1917a and 1920/1917b; compare with Mazlish 1967 as well as Mazlish 1993 and Bruner 1956. Note, however, that I argue for a cyclical, creative tragicomedy, whereas Mazlish argues for a progressive teleological comedy.
62. id quod generat ad quod vult scientias, in *Novum Organum*, I.xlix.
63. Crombie 1994, 8; for Bacon see also Crombie 1994, 1208–09 and 1572–86.
64. Weinberg 1983/1977, 148 and 1974, 43, respectively; see Keller 1991, 87–88.
65. Monod 1972/1970, 160; see Midgley 2002/1985; Keller 1991.
66. Hayles 1999; see also Bertens 1995; compare with Giddens and Pierson 1998, 116f.
67. 'cum homine similitudinem: ut vix ovum ovo videris similis', Tulp 1641, 3.56, p. 274; compare with de Waal and Lanting 1997, 7.
68. See especially Hugh Kenner's brilliant story of Gulliver's place in an intellectual history stretching through Charles Babbage and Alan Turing to Andy Warhol, among others (2005/1968).
69. Minsky 1995/1968; compare with Peirce's discussion of 'thirdness, for example in his third Harvard lecture, 'The Categories Defended' (Peirce 1998, 160–78).

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